COMPARISON OF TOTAL INTRAVENOUS ANAESTHESIA (TIVA) USING PROPOFOL AND INHALATIONAL ANAESTHESIA USING ISOFLURANE FOR CONTROLLED HYPOTENSION IN FUNCTIONAL ENDOSCOPIC SINUS SURGERY(FESS).

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT OF THE TAMIL NADU Dr. M G R MEDICAL UNIVERSITY , CHENNAI, FOR THE DEGREE OF **M D**
(ANAESTHESIOLOGY -BRANCH X) MARCH 2007.

CERTIFICATE

This is to certify that the dissertation entitled: **COMPARISON OF TOTAL INTRAVENOUS ANAESTHESIA (TIVA) USING PROPOFOL AND INHALATIONAL ANAESTHESIA USING ISOFLURANE FOR CONTROLLED HYPOTENSION IN FUNCTIONAL ENDOSCOPIC SINUS SURGERY(FESS).**

is the bonafide work by **Dr. SARAVANAN P.A.** in the partial fulfillment of the requirement for the M.D. Degree (Anaesthesiology-Branch X) of the Dr. M.G.R Medical University, Chennai, to be held in March 2007.

Dr. Manickam Ponniah,
Professor & Head,
Department of Anaesthesiology
Christian Medical College
Vellore 632004,
Tamil Nadu, India.

ACKNOWLEDGEMENT

I wish to express my sincere gratitude to my mentor and guide **Dr. Manickam Ponniah**, Professor and HOD, Department of Anaesthesia for his help, able guidance and valuable suggestions during the course of my study.

I also thank **Dr.Varghese Cherian**, Professor, Department of Anaesthesia, Christian Medical College and Hospital, Vellore for his immense help.

I would like to thank **Dr.Venkatesan**, Lecturer , Department of Anaesthesia for his help and support in doing the study.

I would like to thank **Mr.Pandian** and our anaesthesia technicians for their sincere help in arranging the required equipments and drugs required for this study.

I am thankful to **Mr.Joshua David**, Department of Biostatistics, Christian Medical College and Hospital, Vellore for helping in the statistical analysis.

It has been a learning experience in which all my teachers in the Department of Anaesthesiology and all my colleagues have given me valuable support and guidance.
I am sincerely thankful to all of them.

A word of appreciation and sincere gratitude is due to all the staff in the Department of E.N.T. for their unflinching cooperation.
But for the loving and affectionate support from my family, I would not have been able to complete this study.

I also sincerely thank all the patients who participated and extended their cooperationin the study without whom, this study would not have been possible.
Above all , I am grateful to **God Almighty** for his grace and wisdom to complete this study.

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INTRODUCTION

The aim of Functional Endoscopic Sinus Surgery (FESS) is to restore the drainage and aeration of the paranasal sinuses, while maintaining the natural mucociliary clearance mechanism and seeking to preserve the normal anatomic structures[1,2]. However, this surgery can lead to serious complications such as orbital cellulitis, rhino-oral fistulas, lesions to the optic nerve of the duramater and meningitis[2-4]. These complications are often the result of performing the surgery in the presence of inappropriate bleeding[5]. Hence to reduce the incidence of complications, it is important to have a surgical field as free of blood as possible to improve visibility.

This can be achieved with the use of different anaesthetic techniques to achieve controlled hypotension. The techniques could be based on inhalational anaesthetic or intravenous anaesthetic. Functional endoscopic sinus surgery (FESS) can be performed in some situations solely with local anaesthetics alone.

The mechanism of action and the use of Isoflurane towards the achievement of controlled hypotension is well established.

Total intravenous anaesthesia(TIVA) with Propofol is a relatively new tool for this purpose and not very widely practiced in India because of the cost.

In this study, we propose to compare total intravenous anaesthesia (TIVA) using Propofol versus inhalational anaesthesia using Isoflurane for controlled hypotension in functional endoscopic sinus surgery(FESS)

AIM

To compare total intravenous anaesthesia (TIVA) using Propofol versus inhalational anaesthesia using Isoflurane for controlled hypotension in functional endoscopic sinus surgery(FESS) with respect to

1. Ease of achieving and maintaining acceptable blood pressure.

2. Their effect on

    Intraoperative blood loss.

    Duration of surgery.

    Surgeon’s opinion regarding the surgical field.

3. Incidence of complications.

REVIEW OF LITERATURE

History of the Procedure:

Rhinology and sinus surgery have undergone a tremendous expansion since the discourses of Messerklinger and Wigand in the late 1970s. Imaging advances, increased understanding of the anatomy and the pathophysiology of chronic sinusitis, and image-guided surgery have allowed surgeons to perform more complex procedures with increased safety.

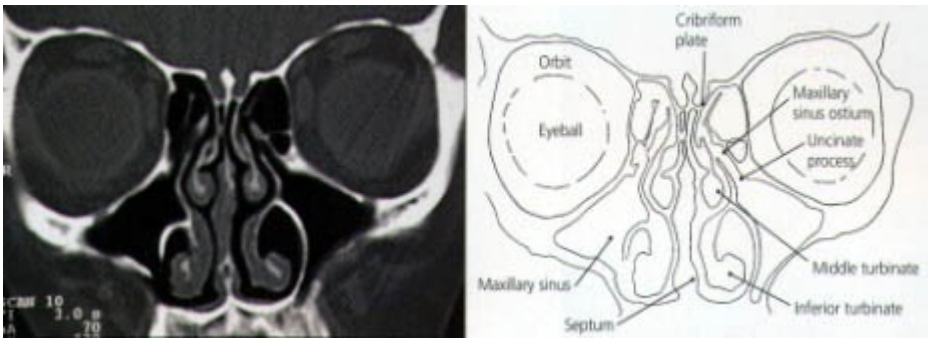
Outstanding short and long-term results have been reported in the literature. Senior et al reported that symptoms improved in 66 of 72 (91.6%) patients following endoscopic sinus surgery, with a mean follow-up time of 7.8 years. In addition, endoscopic sinus surgery significantly influences quality of life; Damm et al reported an improvement in quality of life for 85% of their patient population, with a mean follow-up time of 31.7 months.

Indications:

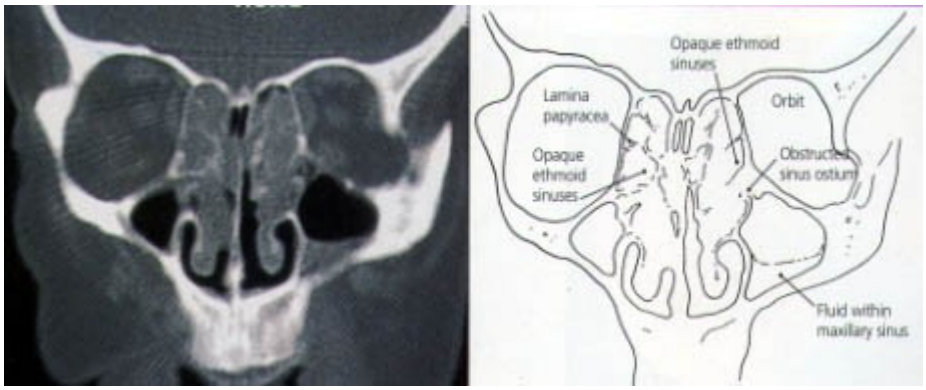
Endoscopic sinus surgery is most commonly performed for inflammatory and infectious sinus disease. The most common indications for endoscopic sinus surgery are as follows

- Chronic sinusitis refractory to medical treatment
- Recurrent sinusitis
- Nasal polyposis
- Antrochoanal polyps
- Sinus mucoceles
- Excision of selected tumours
- Cerebrospinal fluid (CSF) leak closure
- Orbital decompression (eg, Graves ophthalmopathy)
- Optic nerve decompression
- Dacryocystorhinostomy (DCR)
- Choanal atresia repair
- Foreign body removal and

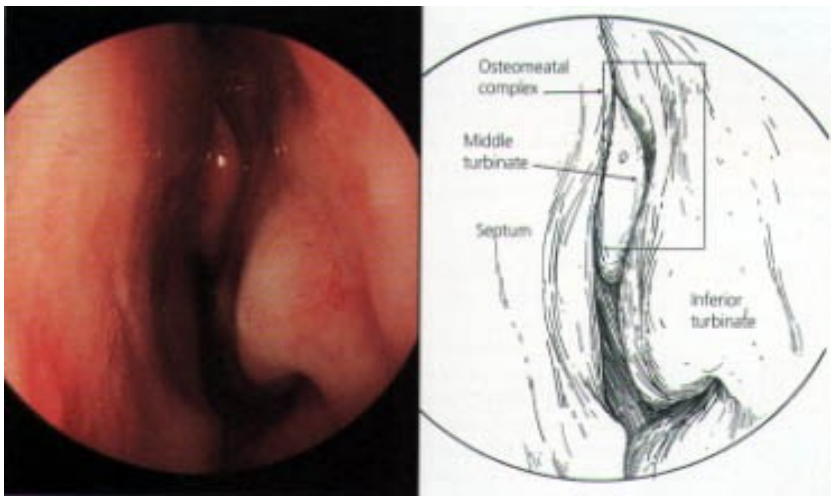
- Epistaxis control.



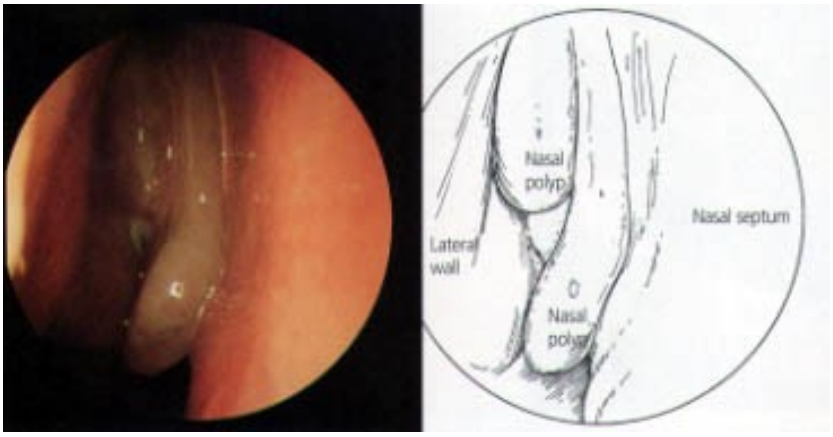
Coronal computed tomographic scan showing normal osteomeatal complex. Patent ostia are visible on both sides, and sinuses are well ventilated.



Coronal computed tomographic scan showing ethmoidal polyps. Ethmoid opacity is total as a result of nasal polyps, with a secondary fluid level in the left maxillary antrum.



Endoscopic appearance of the left nostril in a normal nose. The septum is visible to the left, and the inferior turbinate and middle turbinates are also visible.



Nasal polyps in the left nostril, blocking the osteomeatal complex.(6)

Complications:

Risks associated with endoscopic sinus surgery include bleeding, synechiae formation, orbital injury, diplopia, orbital hematoma, blindness, CSF leak, direct brain injury, nasolacrimal duct injury and epiphora[6].

Anaesthetic techniques:

Various anaesthetic techniques available for this procedure include monitored anaesthesia care, combined topical and infiltration local anaesthesia, inhalational anaesthesia and total intravenous anaesthesia(TIVA).

Monitored anaesthesia care:

The advantages of local anaesthesia are obvious. In most cases local anaesthesia provides excellent hemostasis and thus excellent visibility during the surgical procedure. Local anaesthesia makes it easier to distinguish healthy musosa from diseased musosa, to recognize anatomic narrowings as such, and to remove sections carefully with the least radical procedure. This results in more rapid wound healing and less stress on the patient. With few exceptions, packing is not required in patients operated upon under local anaesthesia.

The risks of local anaesthesia are less than those of general anaesthesia and even older and cardiac risk patients can usually be operated on, without any problems. As already indicated, intraoperative pain has an important warning function that contributes greatly to the avoidance of injury to the roof of the ethmoid, the orbit, and the optic nerve. Another important feature is that local anaesthesia forces the surgeon to exert the greatest care and to proceed as atraumatically as possible. Even the well sedated patient will not tolerate roughness under local anaesthesia. The postoperative recovery time is clearly shorter after local anaesthesia.

Blood loss will be less but the major disadvantage is that there is no airway control.

Controlled hypotension:

Most studies define deliberate hypotension as a reduction in systolic blood pressure to 80 to 90mm Hg. According to another definition , deliberate hypotension is a decrease in mean arterial pressure(MAP) to 50 to 65 mm Hg in normotensive patients[7].

A retrospective study of 37 patients undergoing radical cystectomy for bladder cancer found that the average blood loss was 50% less with deliberate hypotension (versus standard normotensive anaesthesia) [8].

In a study by Vazeery et al, 25 patients were given sodium nitroprusside to lower arterial blood pressure during total hip arthroplasty and had significantly less blood loss than the 25 patients not undergoing deliberate hypotension. Operation room time was also slightly lower for the hypotensive group[9].

Methods of achieving controlled hypotension:

Positioning.

Pharmacological methods.

Positioning:

The commonest method of enhancing a bloodless field by positioning is to elevate the operative site above the level of the heart, while also elevating the legs by breaking the table. This prevents the sudden pooling of blood in the legs.

Pharmacological methods:

A.Volatile anaesthetics:

Halothane, Isoflurane, Sevoflurane.

B.Intravenous anaesthetics

Direct acting vasodilating drugs:

GTN, SNP, Hydralazine

Purine derivatives.

Autonomic ganglion blockers.

Alpha adrenergic blockers.

Beta adrenergic blockers.

Combined alpha and beta blockers.

Calcium channel blockers**.**

History of hypotensive anaestheia:

Hypotensive anaesthesia was first proposed by Cushing in 1917[10] and was first introduced to clinical practice by Gardener in 1946[11].

In 1948, Griffith and Gilles practiced high spinal anaesthesia to produce deliberate hypotension[12].

In 1950's Ganglion blockade with pentamethonium was practiced to decrease arterial pressure[13].

In early 1980's, Halothane was used to produce hypotensive anaesthesia; in late 80's vasodilators and betaadrenergic blockers were used[14].

In the recent years, nitroglycerine, purine derivatives and isoflurane have also been used as sole agents to produce induced hypotension[15].

Indications for hypotensive anaesthesia:

Expected major blood loss:

Head and neck surgery requiring reconstruction.

Pelvic surgery for malignancy.

Large vessel vascular surgery.

Revision hip prosthetic surgery.

Reconstructive spinal surgery.

Complex neurosurgery:

Excision of intracranial or spinal meningiomas.

Arteriovenous malformations.

Pituitary surgery.

Craniofacial reconstruction.

Microsurgery:

Middle ear surgery.

Endoscopic sinus surgery.

Nerve and microvascular surgery.

Plastic free flap grafting.

Intraocular surgery:

Choroidal surgery.

Vitrectomy.

Contraindications to hypotensive anaesthesia:

Hypovolaemia.

Carotid artery stenosis.

Previous ischaemic stroke.

Recent subarachnoid haemorrhage with vascular spasm.

Raised intracranial pressure compromising brain/cord perfusion.

Untreated hypertension.

Claudicating peripheral vascular disease.

Fixed cardiac output-Aortic stenosis/ Cardiomyopathy.

Ischaemic heart disease-Angina or previous infarction.

Renal impairement.

Liver dysfunction.

Pregnancy.

Glaucoma.

INHALATIONAL ANAESTHESIA

General anaesthesia is often preferred because of the discomfort and incomplete block that may accompany topical anaesthesia as well as for providing hypotensive anaesthesia[4]. Hypotensive anaesthesia can be achieved by increasing the inspired concentration of the inhalational agent.

Hypotension after halothane results primarily from myocardial depression that produces a dose-dependant decrease in arterial blood pressure, cardiac output and stroke volume, plus a dose-dependant increase in right heart filling pressure. Although halothane also dilates vessels in the skin, brain and viscera, systemic vascular resistance(SVR) does not decrease significantly because skeletal muscle tone increases; in addition, renal vascular resistance increases[16].

Isoflurane is a non inflammable volatile ananesthetic with a pungent ethereal odour.Although it is a chemical isomer of enflurane, it has different physicochemical properties. Isoflurane causes minimal cardiac depression in vivo. Cardiac output is maintained by a rise in heart rate due to partial preservation of carotid baroreflexes. Isoflurane dilates coronary arteries, particularly if its concentration is abruptly increased, although it is not nearly as potent a dilator as nitroglycerine or adenosine.

Respiratory depression during isoflurane anaesthesia resembles that of other volatile anaesthetics, except that tachypnoea is less pronounced. The net effect is a more pronounced fall in minute ventilation. Despite a tendency to irritate upper airway reflexes, isoflurane is considered a good bronchodilator, but may not be as potent a bronchodilator as halothane.

Like other inhalational anaesthetic agents, isoflurane decreases renal blood flow, glomerular filtration rate and urinary output transiently but hepatic oxygen supply is better

maintained with isoflurane than halothane or enflurane.

Isoflurane is metabolized to one-tenth of the extent of enflurane. Trifluoroacetic acid is the principal end product. Although serum fluoride levels may rise, nephrotoxicity is extremely unlikely even in the presence of enzyme inducers. Prolonged sedation (>24 hours at 0.1-0.6%) of critically ill patients has resulted in elevated plasma fluoride levels without evidence of renal impairement. Non depolarizing muscle relaxants are potentiated by isoflurane. Epinephrine can be safely administered in doses upto 4.5 µg /kg.

In studies on patients and animals, isoflurane decreased blood pressure by decreasing SVR, whereas cardiac output was maintained constantly at clinically relevant concentrations of the anaesthetic[17].

In healthy young people, 2 to 3 % isoflurane decreases MAP by reducing SVR. In older or chronically hypertensive patients, similar concentrations of isoflurane may also decrease cardiac output.

For these individuals, combining a moderate concentration of isoflurane with agents that tend to maintain cardiac output would be more appropriate than using high concentrations of isoflurane alone[18].

In a study by Mandal, 30 patients of either sex in the age group between 19-43 years belonging to ASA grade I or II who underwent functional endoscopis sinus surgery found that hypotensive anaesthesia with isoflurane bleed less compared to normotensive anaesthesia provided by isoflurane. No patients of isoflurane group had any postoperative complication due to intraoperative hypotension[19].

Isoflurane appears to offer certain advantages over other techniques commonly used

to induce hypotension[20]. At lower cerebral perfusion pressures(<30 mmHg), the cerebral metabolic rate for oxygen was better preserved, suggesting cerebral protection. Isoflurane also favorably influenced the global cerebral oxygen supply/demand ratio in humans having a MAP of 50 mmHg[21].

MAC of isoflurane at skin incision can be reduced by 50% and 63% with plasma fentanyl concentrations of 1.67 an 3.0ng/ml, respectively. Increasing plasma fentanyl concentrations from 3.0 to 10 ng/ml only further reduce the MAC of isoflurane from 63% to 82%[22].

TOTAL INTRAVENOUS ANAESTHESIA (TIVA)

Ideal agent for inducing hypotension should have the following properties:

Easy to administer.

Predictable and dose-dependant effect.

Rapid onset and recovery from effects.

Quick elimination without the production of toxic metabolites.

Minimal effects on blood flow to vital organs[23]

Many different intravenous compounds can be employed in a number of combinations to provide TIVA. Most commonly , an opioid is combined with another drug more likely to provide hypnosis and amnesia. By keeping the goals of balanced anaesthesia in mind, combining modern opioids and other drugs, utilizing infusion pumps, and employing an increased understanding of pharmacokinetics, clinicians can successfully perform a wide variety of TIVA techniques.

The optimal propofol-opioid concentrations that ensure adequate anaesthesia and rapid emergence were determined by computer modeling. The optimal propofol concentration decreases in the order of Fentanyl > Alfentanil > Sufentanil > Remifentanil. A

shorter context-sensitive half-time allows the administration of greater amounts of opioids (and less propofol) during anaesthesia without creating prolonged opioid effects[24].

Fentanyl:

Fentanyl is a phenylpiperidine-derivative synthetic opioid agonist that is 75-125 times more potent than morphine. Analgesic effects are mediated at both supraspinal and spinal level like other opioids through mu,kappa and delta opioid receptors. The analgesic effects of fentanyl arise from their ability to inhibit directly the ascending transmission of nociceptive information from the spinal cord dorsal horn and to activate pain control circuits that descend from the midbrain, via, the rostral ventromedial medulla, to the spinal cord dorsal horn.

A three - compartment model is typically used to describe plasma fentanyl concentration decay. The lungs exert a significant first-bypass effect and transiently take up approximately 75% of an injected dose of fentanyl[25] Approximately 80% of fentanyl is bound to plasma proteins, and significant amounts(40%) are taken up by red blood cells[26].

Fentanyl is primarily metabolized in liver by N-dealkylation and hydroxylation. Metabolites begin to appear in the plasma as early as 1.5 minutes after injection. In humans, norfentanyl, the primary metabolite, is detectable in the urine for up to 48 hours after intravenous administration of fentanyl[27].

Approximate fentanyl doses for TIVA.

Loading dose : 4-20 µg / kg.

Maintenance infusion rate: 2-10 µg/ kg/hr.

Range of approximate plasma fentanyl concentration for total intravenous anaesthesia

Analgesia : 1-2ng/ml

Spontaneous ventilation:1-3ng/ml.

Minor surgery:3-6 ng/ml

Major surgery:4-10 ng/ml

Predominant agent : 15-30 ng/ml[28]

The administration of fentanyl prior to, rather than after, noxious stimulation attenuates physiological responses. Fentanyl interacts synergistically and markedly reduces the dose of propofol and other sedative-hypnotics required for loss of consciousness and during noxious stimulation such as skin incision. The timing, rate of administration, and dose of supplemental fentanyl should be tailored before the expected duration of the operation in order to avoid postoperative pain or respiratory depression.

Propofol:

Propofol (2,6-diisopropylphenol) is the most frequently used intravenous anaesthetic today for total intravenous anaesthesia (TIVA). The most prominent effect of propofol is a decrease in arterial blood pressure during induction of anaesthesia.

The vasodilatory effect of propofol appears to be due to reduction in sympathetic activity[29], a direct effect on intracellular smooth muscle calcium mobilization[30], inhibition of prostacyclin synthesis in endothelial cells[31], reduction of angiotensin-II-elicited calcium entry[32], activation of K+ ATP channels, and stimulation of nitric oxide. Stimulation of nitric oxide may be modulated by intralipid rather than propofol[33]. The heart rate does not change significantly

after an induction dose of propofol. It has been suggested that propofol either resets or inhibits the baroreceptor reflex, thus reducing the tachycardic response to hypotension[34].

Induction of anaesthesia with propofol was more rapid than inhalational induction in adults, even when newer volatile anaesthetics with low blood: gas partition coefficients were used[35]. Induction with propofol significantly decreases the incidence of upper airway obstruction compared to halothane[36].When propofol and isoflurane were administered using 'clinically- titrated' methodology, Propofol was found to be associated with improved performance on psychomotor testing during the first hour of recovery[37].

Uses and doses of propofol:

Induction(GA)	:	1-2.5 mg/kg;dose reduced with increasing age.
Maintenance(GA)	:	50-150 µg/kg/min IV combined with N2O or an opiate.
Sedation	:	25-75 µg/kg/min IV
Antiemetic	:	10-20 mg IV; can repeat every 5-10 minutes interval
		or start infusion at 10 µg /kg/min.

The target plasma concentration of propofol for sedation is 0.5-1.5 µg /ml and for hypnosis is 2-6.5 µg /ml [38]

A commonly used scheme for Propofol is injection of a bolus dose of 1mg/kg followed by infusion initially at a rate of 10 mg/kg/hr for 10 min, then 8m/kg/hr for the next 10 min, and a maintenance infusion rate of 6 mg/kg/hr thereafter. This achieves, on average, a plasma concentration of Propofol of 3 µg / ml., and this is effective in achieving satisfactory anaesthesia in unparalysed patients who also receive nitrous oxide and Fentanyl; higher infusion rates are required if Nitrous Oxide and Fentanyl are not administered. These infusion rates must be regarded only as a guide and must be adjusted as necessary according to clinical signs of anaesthesia[39].

Factors which influence the Propofol dosage requirement include

i) Age

ii) Weight

iii) Preexisting medical condition

iv) Type of surgical procedure.

v) Concomitant medical therapy[38].

The context-sensitive half –time of Propofol is less than 25 minutes after infusions lasting as long as 3 hours, and the half-time is still only 50 minutes after prolonged infusions. .Propofol infusions should be terminated 10 to 20 minutes prior to end of anaesthesia if N2O is employed.Otherwise , Propofol infusions should be terminated 5 to 10 minutes before anticipated patient awakening[40]

M.A. Claeys et al studied the haemodynamic effects of propofol, given as a single dose of 2 mg kg^{-1} and immediately followed by a continuous infusion of 6 mg kg^{-1} h^{-1}. Statistically significant decreases in systolic and diastolic arterial pressures were observed 2 min after induction (28% and 19% respectively) and during infusion (30% and 25% respectively) and

were related to decreases in systemic vascular resistance (21% following induction and 30% during infusion). Cardiac output was not affected at any time nor were stroke volume and heart rate. They concluded that the arterial hypotension associated with the induction and infusion of propofol is mainly a result of a decrease in afterload without compensatory increases in heart rate or cardiac output[41].

As a part of balanced or total intravenous anaesthesia(TIVA) technique, infusion rates of 75-300 µg /kg/min are usually required, whereas adequate sedation can be maintained with infusion rates of 25-100 µg /kg/min[38]. When Propofol-N2O was used to maintain outpatient anaesthesia lasting approximately 3 hours, recovery and discharge occurred significantly earlier compared with Isoflurane-N2O combination[42].

When Propofol and Isoflurane were administered using 'clinically -titrated ' methodology, Propofol was found to be associated with improved performance on psychomotor testing during the first hour of recovery[43]. When Propofol and Midazolam infusions were evaluated during monitored anaesthesia care, Propofol was associated with decreased levels of residual sedation, drowsiness, confusion, clumsiness and amnesia compared with Midazolam[44].

Elsharnouby et al did a study in sixty patients (25 female) undergoing functional endoscopic sinus surgery .They were included in two parallel groups. The magnesium group received magnesium sulphate 40 mg kg^{-1} i.v. as a bolus before induction of anaesthesia and 15 mg kg^{-1} h^{-1} by continuous i.v. infusion during the operation. The same volume of isotonic solution was administered to the control group. Intraoperative bleeding was evaluated using a quality scale.

In the magnesium group, there was a reduction in surgical time [68.1 (15.6) min *vs* 88.1 (10.7) min], although the anaesthetic time was 10 min longer and thus presuming a prolongation in anaesthetic emergence. There was a significant reduction of blood loss [165

(19) ml *vs* 257 (21) ml]. The anaesthetic requirements (Fentanyl, Vecuronium and Sevoflurane), mean arterial blood pressure (P<0.005) and heart rate (P<0.005) were also significantly reduced[45].

There is an increasing body of literature suggesting that Propofol possesses antiemetic activity[46]. Antagonism of the dopamine D2 receptor by Propofol has recently been suggested as a possible mechanism for this effect[47]. Compared with the use of volatile agents, the use of propofol for general anaesthesia was associated with less postoperative nausea and vomiting and or decreased requirements for antiemetic medication[48]. Similar findings have been found when using Propofol as an alternative to other intravenous induction or maintanence agents[49].

Borgeat et al used a subhypnotic infusion of propofol (16.7µg/kg/min) or 1 mg/kg/h in 14 patients with emetic symptoms refractory to Ondansetron and Dexamethasone. All patients experienced complete resolution of their symptoms during the infusion period and 12 reported improved appetite[50].

Propofol sedation can be supplemented by opioid analgesia to provide sedation-analgesia for uncomfortable procedures performed without local anaesthesia. During extracorporeal shock wave lithotripsy, a combination of Propofol and Fentanyl produced comparable sedation and improved cardiorespiratory stability compared with an Alfentanil-Midazolam mixture[51].

In a comparison of patient-controlled sedation (PCS) by Propofol and anesthesiologist-administered Fentanyl-Midazolam, the PCS group reported greater satisfaction and more rapid recovery of postoperative cognitive function[52].

Hiroko Iwakiri et al did a study in 50 patients who underwent gynaeocological procedures and found that effect-site concentration of Propofol for recovery of consciousness is virtually independent of Fentanyl effect-site concentration. They also suggested that the

optimal Fentanyl effect-site concentration in patients recovering from gynaecologic laparoscopy is between 1.4 and 2.0 ng/ml. They also found that optimal postoperative Fentanyl effect-site concentration during recovery from GA for laparotomy was 2 ng/ml[53].

In a study by Law et al,38 ASA I-III patients who underwent head and neck surgery were allocated randomly to receive either inhaled Isoflurane or target controlled infusion (TCI) of Propofol . They concluded that maintenance of anaesthesia with Propofol TCI at 2-5 µg / ml does not cause detectable coagulation changes on thromboelastography nor increase surgical blood loss when compared to inhaled Isoflurane[54].

Techniques of administration:

Intermittent bolus technique.

Manual infusion technique.

Target-controlled infusion (TCI) techniques

Intermittent bolus technique:

The traditional intermittent bolus administration of intravenous drugs result in a 'depth' of anaesthesia (and analgesia) that oscillates above and below the desired level[55]. Because of rapid distribution and redistribution of the intravenous anaesthetics, the high peak blood concentration after each bolus is followed by a rapid decrease, producing fluctuating drug levels in the blood and hence the brain. The magnitude of the drug level fluctuation is dependent on the size of the bolus dose and the frequency of its administration. Wide variation in the plasma drug concentrations can result in hemodynamic and respiratory instability as a result of changes in the depth of anaesthesia or sedation.

Manual infusion technique:

By providing more stable blood (and brain) concentrations with a continuous

intravenous infusion, it might be possible to improve anesthetic conditions and hemodynamic stability, as well as decreasing side effects and recovery times with intravenous anesthetics[56]. Administration of intravenous anaesthetics by a variable-rate infusion is a logical extension of the incremental bolus method of drug titration, as a continuous infusion is equivalent to the sequential administration of infinitely small bolus doses.

To more rapidly achieve a therapeutic blood concentration, it is necessary to administer a loading (priming) dose and to maintain the desired drug concentration using a maintenance infusion. Loading dose (Ld) and initial maintenance infusion rate (MIR) can be calculated from previously determined population kinetic values using the following equations.

Ld = Cp (mg/ml) X Vd (ml/kg)

MIR = Cp (mg/ml) X Cl (ml//min)

Ld : Loading dose

Cp : Plasma drug concentration.

Vd : Volume of distribution.

Cl : Drug clearance.

MIR : Maintenance infusion rate.

Continuous infusion can be used in an optimal manner to suppress responses to surgical stimuli by adjusting manual infusion rate according to the individual patient responses. More gradual signs of inadequate or excessive anaesthesia can be treated by making 50-100% changes in the MIR. Abrupt increases in the autonomic activity can be treated by giving a small bolus dose equal to 10-25% of the initial loading dose and increasing the MIR.

Target-controlled infusion (TCI) technique:

Due to marked pharmacokinetic and pharmacodynamic variability that exists among surgical patients, computer programs have been developed that allow reasonable predictions of concentration-time profiles for intravenous anaesthetics and analgesics. This new technology has led to the development of target-controlled infusions (TCI) , whereby the anesthesiologist chooses a “target” blood or brain (effective site) drug concentration and the microprocessor-controlled infusion pump infuses the drug at the rate needed to rapidly achieve and maintain the desired concentration based on population pharmacokinetic-pharmacodynaimc data.

A more advanced form of TCI uses a feedback signal generated by simulating a mathematical model of the control process. Clearly, the precision of control achievable with the model based system is only as accurate as the model. An example of a model-based drug delivery system is the Computer –Assisted Continuous Infusion (CACI) system. An ideal automatic anaesthesia delivery device would titrate anaesthetic to meet the needs of the individual patient using an acquired feedback signal which accurately reflects the effect site concentration of the drug.

The use of a computer-controlled infusion device to achieve a target plasma Propofol derived from population pharmacokinetics resulted in satisfactory levels of sedation during 88

% of the total infusion time[57]. However, a recent comparative study failed to find any clinically significant advantages of the pharmacokinetic-based delivery system compared with conventional manual bolus-infusion schemes[58].

PATIENTS AND METHODS

This study was conducted after obtaining approval from the research and ethics committee of this institution.All adults (16-60 years), ASA I patients scheduled for functional endoscopic sinus surgery were eligible to participate in this study. Patients with bleeding disorders and on anticoagulation therapy were excluded.

Sample size was calculated as 20 in each group based on the previous studies. During the preoperative evaluation, the study details was explained to all these patients. An informed consent was obtained from all those who volunteered for the study. They were randomly allocated to one of the two groups as per the computerized list prepared before the start of the study.

All the patients were premedicated with tablet Diazepam 0.2 mg/kg 1 hour prior to the induction of anaesthesia. On arrival to the operating room, an intravenous cannula was inserted into the forearm and monitoring that included pulse oximeter (Spo2), noninvasive blood pressure (NIBP),electrocardiogram(ECG), end tidal carbondioxide (ETCO2) and end tidal Isoflurane analyzer was established.

Study intervention:

Group 1: Inhalational anaesthesia

Anaesthesia was induced with Midazolam (2 mg), Fentanyl(2 µg/ kg), Propofol (2 mg / kg) , Vecuronium 0.1 mg /kg and ventilated with oxygen ,air and Isoflurane (FIO2 of 0.5). An orotracheal tube was introduced and the oropharynx was packed with a saline soaked throat

pack. An infusion of fentanyl at the rate of 2 µg / kg / hr was started. Anaesthesia was maintained with oxygen , air, Isoflurane and vecuronium was administerd as required. The concentration of isoflurane was adjusted according to the patient's response and to achieve a mean arterial pressure between 60 and 70 mmHg. However , it was decided not to exceed the end tidal concentration of isoflurane above 2% .

Group 2: Total intravenous anaesthesia (TIVA)

Anaesthesia was induced with Midazolam (2 mg), Fentanyl (2µg/kg) , Propofol (2 mg / kg) , Vecuronium 0.1 mg /kg and ventilated with oxygen and air (FIO2 of 0.5). An orotracheal tube was introduced and the oropharynx was packed with a saline soaked throat pack. An infusion of fentanyl at the rate of 2 µg/kg/hr was started . Anaesthesia was maintained with oxygen, air and infusion of propofol. In this group, propofol infusion was started with 12mg /kg / hr for 10 minutes following intubation , then 10mg / kg / hr for next 10 minutes and continued at 8 mg/kg/hr. The infusion rate was adjusted according to the patient's response and to achieve a mean arterial pressure between 60 and 70 mmHg. However it was decided not to exceed the maximal rate of propofol infusion above 12mg /kg / hr .

All the patients were given a 20 degree headup tilt and received normal saline as intravenous fluid at 4ml/kg/hr . Muscle relaxation was maintained with intermittent boluses of vecuronium and assessed by a nerve stimulator. The volume of blood which was sucked and collected in the bottle was measured to assess the amount of blood loss. The second anaesthetist who was not involved in the study made visual assessment of blood soaked gauze pieces used during the surgery. This was also added to the amout of blood loss. The infusion of fentanyl was stopped about 30 minutes before the completion of the procedure in all the patients. Inj.Ondansetron 4mg was given at the end of surgery.The throat pack was

removed at the end of the endoscopic procedure . The residual neuromuscular blockade was reversed with 0.05mg/kg of neostigmine along with 0.02mg/kg atropine before extubation.

Patients were monitored for pain, sedation score, nausea and vomiting following extubation for every 15 minutes in the first hour and every 30 minutes in the next hour in the recovery room.They were also monitored for pain, nausea and vomiting in the ward in the postoperarive period.

Outcome measures:

The outcome measures that were studied had the following goals.

Major:

Is TIVA superior to inhalational anaesthesia in the achievement of controlled hypotension? Is the controlled hypotension easily attained?

Is the achieved controlled hypotension sustained?

Minor:

Was there any correlation between achieved controlled hypotension with the following parameters?

Intraoperative blood loss.

Surgeon's perception of intraoperative surgical field.

Duration of surgery.

Intraoperative surgical field was assessed by using Fromme-Boezaart scale as given below

Surgical field grading: **Fromme –Boezaart scale**

(Evaluation scale for bleeding of surgical field)

Grade O:No bleeding.

Grade 1:Slight bleeding-No suctioning of blood required.

Grade 2:Slight bleeding-Occasional suctioning required.

Surgical field not threatened.

Grade 3:Slight bleeding-Frequent suctioning required.

Bleeding threatens surgical field a few seconds

after suction is removed.

Grade 4:Moderate bleeding- Frequent suctioning required.

Bleeding threatens surgical field directly

after suction is removed.

Grade 5:Severe bleeding-Constant suctioning required.

Bleeding appears faster than can be removed by suction.

Surgical field severly threatened and surgery impossible.

Statistical analysis:

Statistical analysis was done by using descriptive statistics and cross tabulation.Mean and standard deviation were used to assess changes within and between the two groups.A p value of <0.05 was considered to be statistically significant.

RESULTS

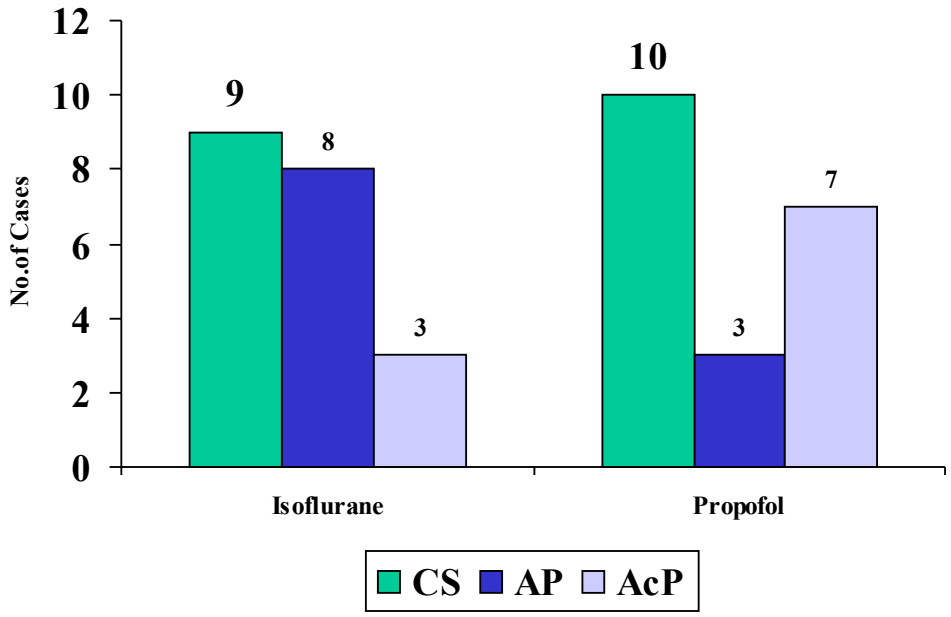
Forty ASA physical status I patients undergoing functional endoscopic sinuses surgery (FESS) were included in the study and randomly allocated into group 1 (Isoflurane) and group 2 (Propofol).

Table 1 shows the demographic data of the study patients.The age, gender, and height were comparable between the two groups, while the patients in group 1 were heavier compared to those in group 2 (P=0.023)

Table 1: Demographic Data

Parameters	Group 1(n=20)	Group 2 (n=20)
Age (Yrs.)		
Mean ± S.D	33.6 ± 12.4	31.55 ± 11.54
(Range)	16-57	16-51
Sex:		
Male	13	11
Female	7	9
Body Weight (Kg)		
Mean ± S.D	61.95 ± 10.72	53.80 ± 10.95
(Range)	40-85	30-70
Height (cm)		
Mean ± S.D	165.15 ± 9.28	161.50 ± 7.63
(Range)	145-180	150-175

Preoperative diagnosis:



CS=Chronic Sinusitis

AP=Allergic Polyposis

AcP=Antrochoanal polyp

The main preoperative diagnosis was chronic sinusitis in both the groups, followed by allergic polyposis in isoflurane group and antrochoanal polyp in propofol group.

Table 2 :**Mean blood pressure MAP(mmHg)**

Time(min)	Isoflurane	Propofol
0	84.8 ± 9.45	81.7 ± 9.84
5	71.05 ± 11.71	72.55 ± 13.04
10	80 ± 15.69	71.4 ± 8.35

15	73.9 ± 10.13	71.2 ± 9.15
20	69.90 ± 8.69	71.05 ± 7.85
25	69.95 ± 6.82	70.7 ± 8.24
30	67.75 ± 7.97	68.35 ± 6.96
40	64.45 ± 6.84	68.35 ± 6.91
50	65.15 ± 6.02	68.85 ± 6.34
60	67.25 ± 7.03	68.78 ± 7.09
70	68 ± 5.85	68.75 ± 5.42
80	68.37 ± 6.40	70.36 ± 5.45
90	68 ± 2.98	72.20 ± 4.61
100	68.66 ± 4.45	74.75 ± 7.81
110	65.91 ± 5.51	73 ± 4.76
120	68.08 ± 7.85	72.67 ± 6.11
130	69.66 ± 7.61	74 ± 4.24
140	69 ± 4.11	81.5 ± 2.12
150	69.14 ± 4.67	78 ± 4.24
160	61.33 ± 5.13	75
170	56 ± 5.66	76
180	63	76

The mean time to achieve the target mean blood pressure is 18 minutes in isoflurane group and 16 minutes in propofol group.There was no significant difference (P=0.66) between the two groups with regard to median time in achieving target blood pressure(18-28 minutes).

Mean Arterial pressure (mmHg)

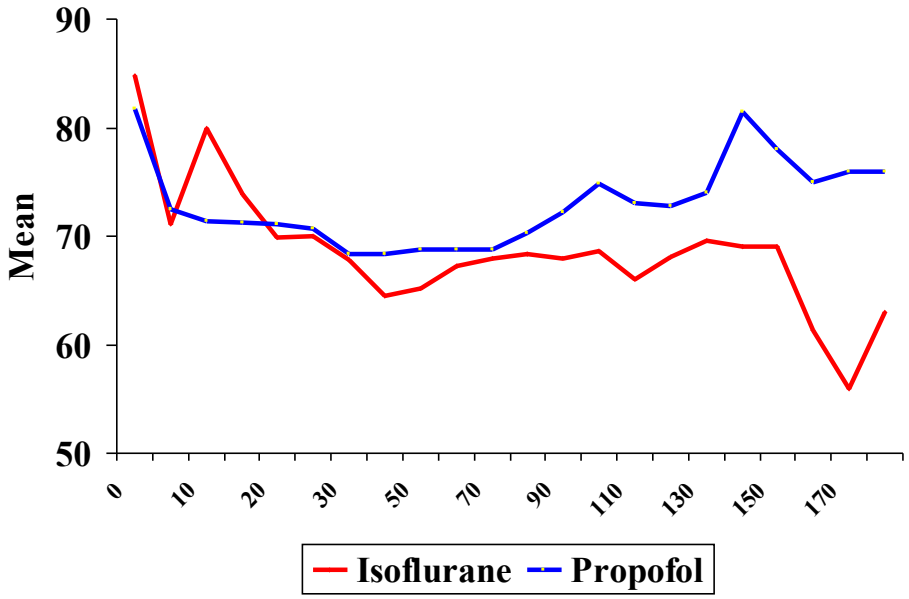
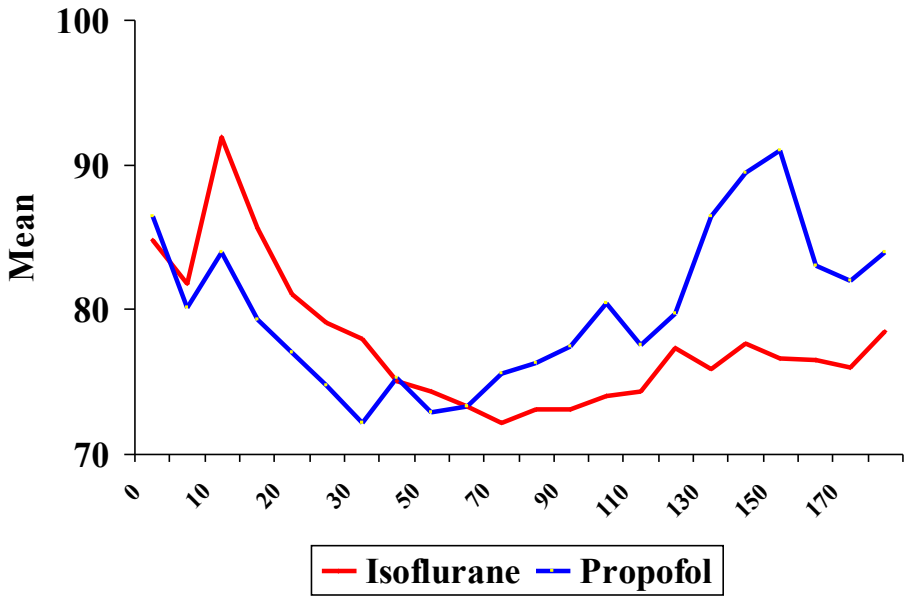


Table 3 : **Mean Heart Rate(beats/min)**

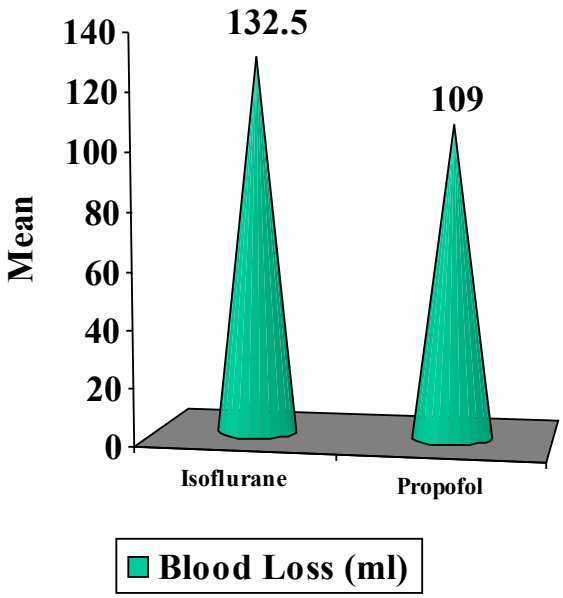
Time	Isoflurane	Propofol
0	84.85 ±15.39	86.4 ±18.84
5	81.85 ± 12.08	80.10 ±18.72
10	91.9 ± 11.53	84 ± 15.48
15	85.65 ± 10.83	79.25 ±11.27
20	81.15 ± 11.80	77 ± 9.14
25	79.10 ±10.10	74.75 ± 10.96
30	77.95 ±13.40	72.25 ±10.07
40	75.10 ± 11.24	75.35 ±11.30
50	74.30 ±9.34	72.95 ±8.85
60	73.30 ±8.39	73.26 ±9.71
70	72.16 ±8.19	75.58 ± 12.67
80	73.06 ±8.35	76.27 ±10.59
90	73.13 ±7.45	77.44 ±12.23
100	74 ±7.11	80.50 ± 12.65
110	74.25 ±8.90	77.75 ±15.79
120	77.25 ±9.46	79.67 ±17.89
130	75.89 ±9.79	86.50 ± .71
140	77.62 ±9.01	89.5 ± 4.95
150	76.57 ± 10.52	91 ±1.41
160	76.50 ± 8.06	83
170	76 ± 11.14	82
180	78.5 ±3.53	84

When compared to the baseline, there was no significant difference between the two groups in terms of heart rate measured at different time intervals.

Mean Heart Rate (Beats / min)



Intraoperative blood loss(ml)



Group	Mean ± S.D.
Isoflurane	132.5± 62.15
Propofol	109 ±82.96

Table 4:Intraoperative blood loss(ml)

Group	<100ml	>100ml
Isoflurane	11	9
Propofol	15	5

There was no statistical significant difference(P= 0.402) between these two groups in terms of intraoperative blood loss.

Surgical field grading:

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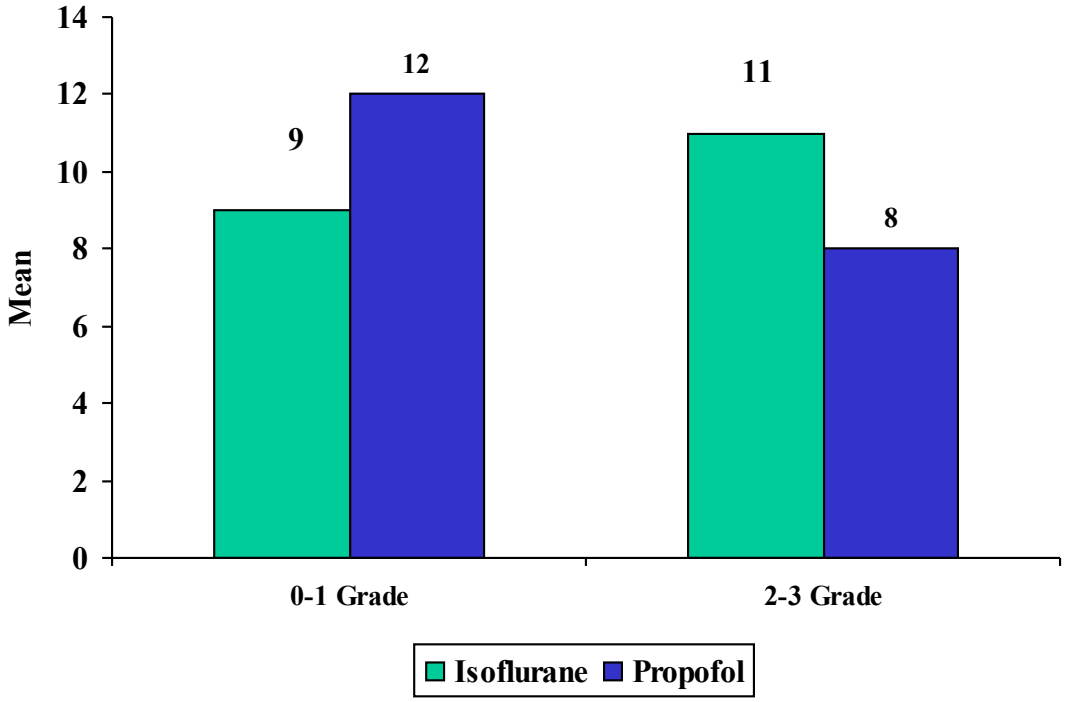

The operative field conditions were similar in both the groups (P=0.34)

Table 5 : Postoperative pain, nausea and vomiting:

Group	Pain	Nausea	Vomiting
Isoflurane(n=20)	0	0	0
Propofol(n=20)	0	0	0

None of the patients had pain, nausea and vomiting in the postoperative period.

uration of surgery(min):

The duration of surgery in group 1 was 131.5 ± 36.6 (min) and in group 2 was 98 ± 41.4 (min) .This was statistically significant (P <0.007)

Table 6: Duration of surgery(min)

Group	Mean ± S.D.(min)
Isoflurane	131.5 ± 36.3
Propofol	98 ± 41.4

Table 7: Duration of surgery in both groups:

Group	<90(min)	>90(min)
Isoflurane	3	17
Propofol	12	8

All patients underwent the same type of surgery. The duration of surgery was less with propofol group when compared to isoflurane group which is statistically significant

(P= 0.01)

Mean fentanyl requirement (µg/kg):

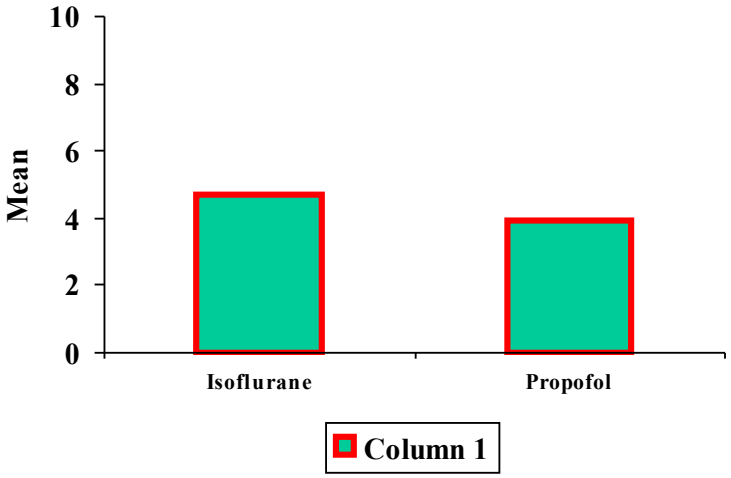

Table 8: **Mean fentanyl requirement(µg/kg)**

Group	Minimum	Maximum	Mean
Isoflurane	3.50	6.5	4.68±1.07
Propofol	3.0	7	3.94±0.96

The mean fentanyl requirement was greater with isoflurane group 4.68 ±1.07 (µg/kg) when compared to propofol group 3.94±0.96 (µg/kg) which was statistically significant(P=0.026)

Surgeon's satisfaction

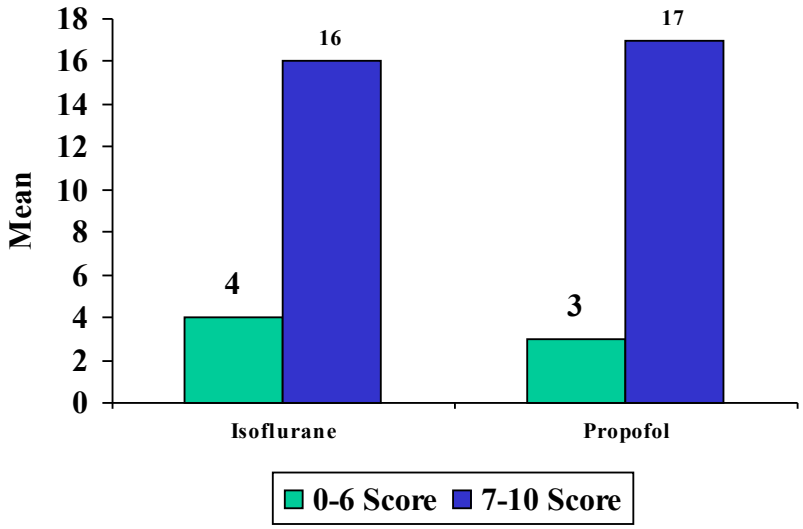

Table 9:**Surgeon's satisfaction**

Score	Isoflurane	Propofol
0-6	4	3
7-10	16	17

Surgeon's satisfaction score was similar in both groups(P=0.173) which was not statistically significant.

Table 10 :**Sedation score-Isoflurane**

Time(Min)	0-1(score)	2-3(score)
0	15	5
15	16	4
30	19	1
45	19	1
60	19	1
90	20	0
120	20	0

Table 11:Sedation score-Propofol

Time(Min)	0-1 (score)	2-3(score)
0	17	3
15	18	2
30	19	1
45	20	0
60	20	0
90	20	0
120	20	0

There was no significant difference in the sedation score in both the groups.

Stay in hospital (hrs)

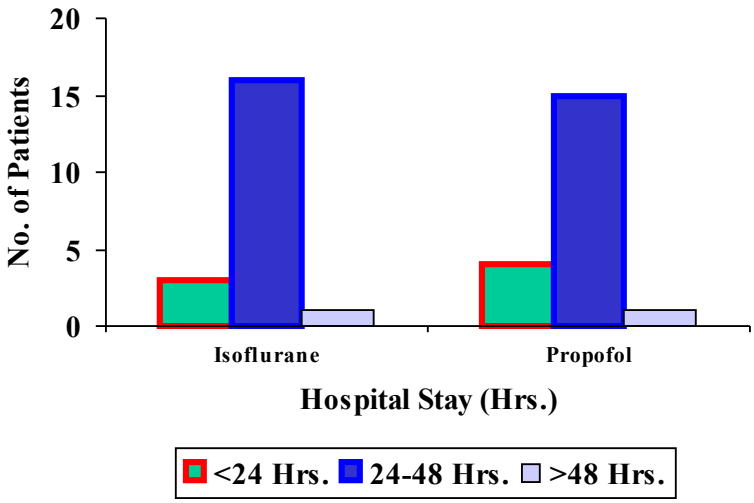

Table 12: **Stay in hospital(hrs)**

Group	Isoflurane	Propofol
<24	3	4
24-48	16	15
>48	1	1

The average duration of stay in both the groups was 24-48 hours. There was no statistically significant difference between the two groups in terms of hospital stay.

DISCUSSION

Isoflurane based anaesthetic techniques for achieving controlled hypotension for different types of surgeries including functional endoscopic sinus surgery(FESS) have gained wide popularity. This technique is simple, economical and can be practiced wherever a general anaesthetic is given with a relatively modern anaesthetic machine in India.

However, there is always a need to explore newer techniques and drugs to try and achieve better results and conditions for surgeries like functional endoscopic sinus surgery(FESS) .One such technique that is gaining tremendous popularity for controlled hypotension is total intravenous anaesthesia (TIVA) with propofol and remifentanil particularly in the western countries. Remifentanil is not freely available in our country. The cost of remifentanil in India would also be prohibitive for routine use.

Hence this study was designed to evaluate total intravenous anaesthesia (TIVA) with propofol and fentanyl and to determine whether better results and operative conditions can be achieved when compared to conventional isoflurane based anaesthetic technique.

In this study, the goal was to achieve a target mean blood pressure of 60-70mmHg. It was possible to achieve this goal in both the groups. Both groups took the same time to achieve the target blood pressure with the mean time of 18 minutes in isoflurane group,16 minutes in propofol group and median time of 10 minutes in both the groups. Hence isoflurane based technique is equally capable of producing controlled hypotension as the propofol based technique.The highest concentration used in isoflurane group to achieve target blood pressure was an end tidal concentration of 2%.

In a study by Tirelli et al, mean arterial pressure of 60-70 mmHg was aimed for in

FESS using isoflurane in one group and total intravenous anaesthesia (TIVA) using propofol in another group.A concentration of 1-2% of isoflurane was used for the maintenance which is almost similar to our study.

In a study by Mandal, hypotensive anaesthesia in functional endoscopic sinus surgery (FESS) was achieved in a group of 30 patients using isoflurane.The mean inspired isoflurane concentration used was 3.8%(Range 1.6-4.5%).A mean of 55-60 mmHg was aimed in his study when compared with a mean of 60-70mmHg in our study. This could be the reason why higher concentration of isoflurane was required in that study.

In our study, maintenance of target blood pressure within the 60-70mmHg range was more consistent with isoflurane group when compared to the propofol group. This is particularly appreciable when observing the graph where there are several departures away from the target zone in the propofol group.

In a study by Tirelli et al, hypotensive anaesthesia(MAP:60-70mmHg) was achieved with TIVA using propofol and remifentanil. Rate of propofol used was 35-45 ml/hr whereas in our study, we used the infusion rate based on the patients body weight and haemodynamic response.The use of remifentanil here allows a very much decreased infusion rate of propofol as compared to our study . Other factors which influence the propofol dosage requirement include age, weight, preexisting medical condition, type of surgical procedure and concomitant medical therapy[38].

When compared to the baseline, there was no significant difference between the two groups in terms of heart rate measured at different time intervals. The absence of tachycardia suggests that both the groups experienced adequate depth of anaesthesia and analgesia because of the concomitant use of fentanyl. None of the patients had intraoperative awareness which was enquired in the post operative follow up.

There was no significant difference in the intraoperative blood loss between the two

groups. The mean blood loss in isoflurane group was 132.5±92.15 ml and in the propofol group was 109± 82.96 ml .The reduced blood loss in both the groups reflects effective controlled hypotension by both the techniques.

In a study by Mandal,30 patients of either sex in the age group between 19-43 years with ASA grade I or II underwent functional endoscopis sinus surgery and it was found that hypotensive anaesthesia with isoflurane resulted in less bleeding compared to normotensive anaesthesia provided by isoflurane. No patients of isoflurane group had any postoperative complication due to intraoperative hypotension[19].

In our study, the operative field assessed by Fromme-Boezzart scale was similar in both the groups and there was no significant difference between these two groups. All patients in both the groups belonged to grade 3 and below, which denotes highly acceptable surgical field as far as the surgeon was concerned.

However, in a study by Tirelli, surgical field grading was better with propofol group with a mean surgical field grade of 2.48±0.51 when compared to isoflurane group with a mean of 3.05± 0.57. They attributed this favourable field in the propofol group to be due to the direct effect on intracellular smooth muscle calcium mobilization of propofol causing reduced bleeding. They also postulated that increase ooze in the isoflurane group could be due to the vasodilating property of isoflurane[30]. Our findings do not match those of Tirelli group.

In a study by Nair, Salil et al in FESS using beta blocker for controlled hypotension, they found that there was a significant difference in overall mean heart rate between the placebo and [beta]-blocker groups ($P < .0001$). In the entire group, surgical grade correlated with heart rate ($P < .05$) but not with mean arterial blood pressure. Mean surgical grade was similar between the placebo and beta-blocker groups, but early in the study a significantly better surgical field was recorded in the beta-blocker group ($P < .001$). Surgical grade was significantly better in those with a mean heart rate of less than 60 beats per minute ($P <$.

02)[59]. We achieved acceptable surgical conditions even though the heart rate in both the groups of our study was above 60 beats/min.

The mean fentanyl requirement was greater with isoflurane group when compared to the propofol group.This could be due to the prolonged surgery in the isoflurane group when compared to propofol group

MAC of isoflurane at skin incision can be reduced by 50% and 63% with plasma fentanyl concentrations of 1.67 and 3.0ng/ml, respectively. Increasing plasma fentanyl concentrations from 3.0 to 10 ng/ml only further reduces the MAC of isoflurane from 63% to 82%[22]. This could explain the lower requirement of inspired concentration of isoflurane in our study when compared to Mandal study where he used the mean inspired concentration of 3.5% isoflurane to achieve controlled hypotension.

In our study however, none of the patients in both the groups had nausea and vomiting in the postoperative period. This could be due to prophylactic administraton of Ondansetron and avoidance of Nitrous Oxide in both the groups. The use of propofol can be associated with less postoperative nausea and vomiting or decreased requirements for antiemetic medication[48].

In a study by Klazina Visser et al, elective inpatients(1447) and outpatients(563) were randomly assigned to inhalational anaesthesia with isoflurane-nitrous oxide or TIVA with propofol-air. They concluded that propofol TIVA results in a clinically relevant reduction of postoperative nausea and vomiting compared with isoflurane-nitrous oxide anaesthesia. Both anaesthetic techniques were otherwise similar. Anaesthetic costs were more than three times greater for propofol TIVA, without economic gains from shorter stay in the postanaesthesia care unit[60]. If this study had eliminated nitrous oxide in the inhalational group, as we did, they might have found less incidence of postoperative nausea and vomiting in the inhalational

group also.

There was no significant difference in the sedation score in both the groups. This could be due to the rapid distribution and elimination half-life of propofol.The required decrease in concentration for awakening after anaesthesia or sedation with propofol is generally less than 50 % of plasma concentration. Recovery from propofol remains rapid even after prolonged infusions. The equally rapid recovery in the isoflurane group in our study could be due to low blood gas partition coefficient of 1.4 and the titration of anaesthetic concentration using anaesthetic gas analyzer towards the time of extubation.

The duration of stay in hospital was similar in both the groups with the average duration of 24-48 hours. This could be due to the shorter acting anaesthetic drugs.

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CONCLUSION

1. Controlled hypotension can be achieved equally effectively using inhalational anaesthesia with isoflurane as well as total intravenous anaesthesia (TIVA) using propofol .

2. Total intravenous anaesthesia (TIVA) using propofol offers no significant advantage over the conventionally used inhalational anaesthetic technique using isoflurane in terms of operative conditions and intraoperative blood loss.

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PROFORMA

COMPARISON OF TOTAL INTRAVENOUS ANAESTHESIA (TIVA) USING PROPOFOL VERSUS INHALATIONAL ANAESTHESIA (ISOFLURANE) IN ENDOSCOPIC SINUS SURGERY.

Name: Age:

Sex: Hospital No:

Height: Weight:

Clinical diagnosis: Surgery:

Premedication:

Monitors: Spo2 / NIBP / ECG / ETCO2.

Induction: Air + O2 + Isoflurane/Propofol	Dosage	Time
Midazolam	2mg	
Fentanyl	2 µg/kg	
Propofol	2mg/kg	
Vecuronium	0.1mg/kg	

Maintenance: Air + O2 + Isoflurane/Propofol

Fentanyl infusion started at 2µg/kg/hr at

Propofol infusion started at

Variables	0	5	10	15	20	25	30	40	50	60
MAP										
SBP/DBP										
HR										
ETCO2										
SPO2										
Isoflurane										
Inh con										
End tidal										
Propofol										
TOF										

Monitoring continuation

Variables	70	80	90	100	110	120	130	140	150	160	170	180
MAP												
SBP/DBP												
HR												
ETCO2												
SPO2												
Isoflurane												
Inh Conc.												
End tidal												
Propofol												
TOF												

Total drug used for the procedure:

Fentanyl(µg):

Propofol(mg):

Vecuronium(mg):

Time of switching off Isoflurane:
Fentanyl:
Propofol:
Time of reversal:

Time of extubation:

Intraop blood loss:

Intraop complications and management:

Surgical field grading:**Fromme –Boezaart scale**
(Evaluation scale for bleeding of surgical field)
Grade O:No bleeding.
Grade 1:Slight bleeding-No suctioning of blood required.
Grade 2:Slight bleeding-Occasional suctioning required.
Surgical field not threatened.
Grade 3:Slight bleeding-Frequent suctioning required.
Bleeding threatens surgical field a few seconds
after suction is removed.
Grade 4:Moderate bleeding- Frequent suctioning required.
Bleeding threatens surgical field directly
after suction is removed.
Grade 5:Severe bleeding-Constant suctioning required.
Bleeding appears faster than can be removed by suction.
Surgical field severly threatened and surgery impossible.
Surgeon's satisfaction:

Post op:
Pain score(0-10):

Sedation score:0 = Patient is awake.
1 = Mild(occasionally drowsy)
2 = Moderate(frequently drowsy,easily rousable)
3 = Severe (difficult to rouse)
S = sleeping(easy to rouse)

	Postextubation	15min	30min	45min	60min	90min	120min
Pain Score							
Sedation Score							
Nausea/ Vomiting							
Medications (If any)							

Requirement in postop period(ward)

Analgesia:

Antiemetics:

Post op complications and management:

Duration of stay in post op period:

Information to the patient and consent form

Introduction

Hello my name is Dr. Saravanan.P.A. and I'm working in the department of Anesthesiology CMC Hospital Vellore. We are conducting a study that would help to control blood loss during the surgery and post operative benefits like pain,nausea,vomiting and recovery.Firstly the procedure is done only in the presence of senior supervision inside the Operation theatre with standard monitoring.

Study procedure

As you know,endoscopic sinus surgery is done for sinus problems and is done in operation theatre. It is important to have surgical field as free of blood as possible to improve visibility.This can be achieved by providing blood pressue on lower side(controlled hypotension) intraoperatively using general anaesthesia or total intravenous anaesthesia using propofol. General anaesthesia(GA) is the standard anaesthetic technique today. Total intravenous anaesthesia(TIVA) is a good alternative technique.Both the techniques are equally good and safe to you.

For anaesthesia,you will be kept fasting for 6 hours and premedicated with sedation 1 hour before anaesthesia.After premedication,you will be taken inside the operation theatre where you will be started an I.V. access under senior anaesthetist supervision.After establishing monitors,you will be asked to take good breaths through mask with oxygen Meanwhile,you will be given intravenous drugs to put you to sleep .Depending on the randomization,you will be getting general anaesthesia using gaseous agent(isoflurane)or intravenous anaesthesia using propfol .Your vitals will be monitored intraoperatively using standard monitoring.At the end of the procedure,you will be waken up after adequate reversal.Since your nose will be blocked following the surgery,you are advised to breathe through mouth .You will be kept and monitored in the post op recovery room by the conventionally trained staffs for 1-2 hours and then in the ward for 48 hours.

Benefits

By this study,the intraoperative blood loss will be less .By providing better surgical field,surgery duration will be minimized and anaesthesia duration also.You will be comfortable during emergence and postoperative period .Nausea and vomiting which is more common after any GA will be less .You will be given adequate pain relief during the procedure and post operative period also.

Discomforts and Risks

It will be the same like other general anaesthesia complications like problems due to anaesthesia or problems due to surgery.Anaesthetic problems will be lntraoperative or postoperative.Intraoperative problems include bradycardia,hypotension,arrythmias,problems of endotracheal tube intubation.Postop problems will be pain,nausea,vomiting,respiratory difficulties.Problems due to surgery will be bleeding,blindness,cerebrospinal fluid leak,subcutaneous orbital emphysema,synechiae formation.

Compensation

You will not have to pay any additional money for participating in the study. Though complications are unexpected, if any arise, medical care will be given free of cost.

Confidentiality

Your name will not appear on the study records. Information related to you will be marked in a code sheet and only the study doctor will be able to link your name with the code number.

Participation in the study

Your participation in this study is entirely voluntary and you have the right to refuse to volunteer for

this study. Your care will not be affected by this decision. However if you volunteer, you are required to sign or put your thumb print on the following consent form.

Consent

I have read this consent form and have discussed the procedure with Dr.Saravanan.P.A.. The details of this study have been explained to me. I have been given the opportunities to ask questions, which have been answered to my satisfaction. I understand that this study is voluntary .I understand that I may refuse to participate in the study and my care will not be affected by this study. I give my consent to be enrolled in this study.

Signature of the Participant

Signature of the Anaesthetist.

KEY TO MASTER CHART

Group: 1=Isoflurane**,**2=Propofol

Hosp no:Nospital Number.

Clindiag:Clinical diagnosis.

Premeds:Premedication : 1=Tab.Valium(10mg), 2=Tab.Valium (7.5mg)

3=Tab.Valium (5mg)

Indagent:Induction agent: 1=Isoflurane,2=Propofol

Timeind:Induction time.

Startmaint:Time at which maintenance drugs were started.

Stop iso:Time of switching off isoflurane.

Duriso:Duration of isoflurane(minutes).

Stopfenta: Time of switching off fentanyl.

Durfenta: Duration of fentanyl(minutes).

FENT TL:Total fentanyl used(µg /kg)

Stoppropo: Time of switching off propofol

Durpropo: Duration of propofol(minutes).

PFOL_TL:Total propofol usage(mg)

MAP_5 indicates mean arterial pressure at 5 minutes.

SBP_5: Systolic blood pressure at 5 minutes.

DBP_5: Diastolic blood pressure at 5 minutes.

HR_5: Heart rate at 5 minutes.

IISO_0: Inspired concentration of isoflurane at induction.

IISO_5: Inspired concentration of isoflurane at 5 minutes.

.ETISO_0: End tidal concentration of isoflurane at induction.

ETISO_5: End tidal concentration of isoflurane at 5 minutes.

PFOL_0:Propofol infusion rate (mg/kg/hr) at induction.

PFOL_5: Propofol infusion rate (mg/kg/hr) at 5 minutes.

REV_TIME:Reversal time

EXT_TIME:Extubation time.

IOP_BL:Intraoperative blood loss

IOP_COMP:Intraoperative complications

SF_GRAD:Surgical field grading

PAIN_PE:Pain in immediate postextubation period

PAIN_15:Pain at 15 minutes

SS_PE:Sedation score in the immediate postextubation period

SS_15: Sedation score at 15 minutes.

NV_PE:Nausea and vomiting at immediate postextubation period.

NV_15: Nausea and vomiting at 15 minutes.

POANAL: Requirement of analgesia in postoperative period.

POAMETIC:Requirement of antiemetic in postoperative period.

POCOMP:Postoperative complications.

STAY;Duration of stay in hospital.

SRN_S:Surgeon’s satisfaction.

dur_sur;Duration of surgery